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# The effects of food availability on growth and reproduction of *Daphnia magna* exposed to silver nanoparticles

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## Abstract

The number of available studies on the acute effects of silver nanoparticles (AgNP) on aquatic organisms has increased dramatically in recent years, but there is still very limited information available on chronic effects. In this study, a series of *Daphnia magna* 21-days reproduction test (OECD 211) were performed using 30 nm citric acid stabilized AgNP.

The aim of the study was, besides providing data for the chronic toxicity of AgNP, to study the influence of the food availability on the reproductive toxicity of AgNP in *Daphnia magna*. The exposure concentrations applied ranged from 2 to 50 µgAg/L, and the test animals were fed with green algae *Pseudokirchneriella subcapitata* in amounts of approximately 0.12 mgC/Daphnia/day for standard treatment or 0.36 mgC/Daphnia/day for high food availability treatment. The parameters of interest were survival, growth rate of mother animals, days to first live offspring, and number of neonates produced. The data obtained from the chronic tests are intended for modeling using the Dynamic Energy Budget (DEB) theory, which will hopefully provide information on growth and reproduction strategy of the test animals. The concentrations of silver in the test medium over time were measured by ICP-OES and the size of the particles in the medium was measured with DLS.

With standard food treatment no significant effects were observed for concentrations lower than 10 µgAg/L. The animals exposed to 10 µgAg/L were slightly bigger and produced more offspring in comparison to controls, whereas concentrations above 10 µgAg/L resulted in inhibition of growth and reproduction as well as an increased mortality.

The addition of higher amounts of food showed a beneficial effect on animal survival, growth and reproduction. Similar as in normal food availability treatment, animals exposed to 10 µgAg/L showed enhanced reproduction compared to controls, however the toxic effects on growth and reproduction appeared in concentrations above 20 µgAg/L.

A reference test was performed with silver nitrate in concentrations ranging from 0.25 to 1.5 µgAg/L. Mortality was increasing in concentrations above 0.25 µgAg/L, but other than that no significant effects were observed of any of the tested exposure concentrations compared to the control.

This study shows that the amount of food available highly influences the reproductive toxicity of AgNP in *Daphnia magna* and modeling efforts are ongoing to reveal the survival and reproductive strategy of the animals.